e) selectively depositing a metal layer on the underlayer exposed in the feature.

16. The method of claim 15, wherein the first barrier layer and the second barrier layer comprise Si_xN_y.

17. The method of claim 16, wherein the first barrier layer and the second barrier layer are formed using chemical vapor deposition techniques.

18. The method of claim 17, wherein the second barrier layer is removed from the bottom of the feature by sputter etching techniques.

21. The method of claim 15, wherein the metal layer comprises copper.

23. The method of claim 15, wherein the metal layer is deposited using electroplating techniques.

REMARKS

This is intended as a full and complete response to the Final Office Action dated October 10, 2001, having a shortened statutory period for response set to expire on January 10, 2001. Claims 15-18, 21, and 23 were considered and stand rejected by the Examiner. Applicants believe that no new matter has been introduced in this response.

Claims 15-18, 21, and 23 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Taguchi et al.* (U.S. Patent No. 5,308,793) in view of *Zhao et al.* (U.S. Patent No. 5,674,787) and *Sliwa et al.* (U.S. Patent No. 4,962,060). The Examiner states that it would have been obvious to form a titanium nitride layer on the underlying interconnect of *Taguchi et al.* for the disclosed intended purpose of *Zhao et al.* of serving as an anti-reflective coating and/or as an electromigration/stress migration suppression layer, and to selectively deposit the copper layer on the titanium nitride layer in order to form a copper interconnect. The

Examiner further asserts that *Silwa et al.* discloses depositing copper by an electroless or an electroplating process. Applicants respectfully traverse this rejection.

Taguchi et al. discloses deposition of a first silicon nitride (SiN) layer 21 over a PSG layer 20, etching a contact hole 20a to a silicide layer 17a, depositing a second SiN layer 22 on the silicon nitride layer 21 and the silicide layer 17a, etching the SiN layer 22 so that only the walls of the contact hole 20a are covered with the second silicon nitride layer 22a, depositing a conformal titanium barrier layer on the second silicon nitride layer 22a and the silicide layer 17a in order to provide an improved wetting surface for aluminum fill of a hole. (See, col. 7, lines 32-63, and Figures 6-11) *Taguchi et al.* teaches the formation of a barrier layer on the bottom of a hole prior to deposition of aluminum and teaches that layers are non-selectively deposited. *Taguchi et al.* does not disclose selectively depositing a metal layer on the underlayer exposed in the feature.

Zhao et al. discloses depositing a interlayer dielectric (ILD) layer 12 over a titanium nitride (TiN) barrier layer 13 disposed on a metal 11, etching the ILD layer 12 to expose the TiN barrier layer 13 (or optionally etching the ILD layer 12 and the TiN barrier layer 13 to expose the metal 11) by a via 15, depositing a dielectric layer 16 over the ILD layer 12 and the exposed portion of TIN layer 12 (or optionally, metal 11) within the via 15, etching the dielectric layer 16 to remove the dielectric layer 16 from the surface of the ILD layer 12 and the bottom of the via 15 to retain dielectric layer 16 on the sidewalls 17, and depositing an activation layer 21 (or optionally 27) on the exposed bottom of the via 15 prior to depositing a plug 23. (See, col. 5 line 47, to col. 7, line 35, and Figures 2-6, see also col. 9 line 11, to col. 10, line 28, and Figures 7-13. *Zhao et al.* does not disclose depositing a first barrier layer over a blanket dielectric layer and forming a feature through the first barrier layer and the dielectric layer to expose an underlayer.

Sliwa et al. discloses the use of sidewall spacers of a conductive material on an aluminum interconnect to improve oxide planarization and inhibit whisker formation and voiding due to electromigration in aluminum interconnect formation. *Sliwa et al.*, does not disclose depositing a first barrier layer over a blanket dielectric layer, forming a feature through the first barrier layer and the dielectric layer to expose an underlayer, depositing a second barrier layer on the bottom and sidewalls

Although it does disclose a first barrier

of the feature, removing the second barrier layer formed at the bottom of the feature, and selectively depositing a metal layer on the underlayer exposed in the feature.

Taguchi et al., *Zhao et al.*, and *Sliwa et al.*, alone or in combination, do not teach, show, or suggest depositing a first barrier layer over a blanket dielectric layer, forming a feature through the first barrier layer and the dielectric layer to expose an underlayer, depositing a second barrier layer on the bottom and sidewalls of the feature, removing the second barrier layer formed at the bottom of the feature, and selectively depositing a metal layer on the underlayer exposed in the feature, as recited in claim 15, and claims dependent thereon. There is no suggestion or motivation to combine *Taguchi et al.*'s conformal titanium barrier layer in order to provide an improved wetting surface for aluminum fill of an opening with *Zhao et al.*'s deposition of an activation layer 21 on the exposed bottom of the via 15 prior to deposit a plug 23. Withdrawal of the rejection is respectfully requested.

The prior art made of record is noted. However, it is believed that the secondary references are no more pertinent to the Applicants' disclosure than the primary references cited in the office action. Therefore, it is believed that a detailed discussion of the secondary references is not deemed necessary for a full and complete response to this office action. Accordingly, allowance of the claims is respectfully requested.

In conclusion, the references cited by the Examiner, neither alone nor in combination, teach, show, or suggest claimed aspects of the invention. Having addressed all issues set out in the office action, applicants respectfully submit that the claims are in condition for allowance and respectfully request that the claims be allowed.

Respectfully submitted,

Keith M. Tackett
Registration No. 32,008
MOSER, PATTERSON, & SHERIDAN L.L.P.
3040 Post Oak Blvd., Suite 1500
Houston, TX 77056
Telephone: (713) 623-4844
Facsimile: (713) 623-4846
Attorney for Applicant(s)